Panasonic/Sanyo A/C Interface – Modbus TCP Installation Instructions

Preface

Safety warnings

To avoid injury, or damage to the TCP interface, read all installation and configuration instructions in this guide before installing.

⚠ CAUTION
Do not expose to rain or moisture.

⚠ CAUTION
The installation and assembly of electrical equipment may only be performed by a skilled electrician, improper installation by the user may result in electric shock or fire.

Maintenance
This product contains no user serviceable parts.

WEEE Directive
At the end of their useful life the packaging, product, and any battery should be disposed of by a suitable recycling centre.
Do not dispose of with normal household waste.
Do not burn.

Disclaimer

Warranty

All products manufactured by t-mac Technologies Ltd are warranted against defective materials for a period of one year from the date of delivery to the original purchaser.

⚠ Warning
If the TCP interface is installed in a manner other than that specified in these instructions, the protection provided by the unit may be impaired. t-mac Technologies Ltd assume no liability for damages consequent to the user/installer of this product. We reserve the right to change this manual at any time without notice. The information furnished by us is believed to be accurate and reliable. However, no responsibility is assumed by us for its use, nor for any infringements of patents or other rights of third parties resulting from its use.

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t-mac Technologies Ltd
Stand Park
Sheffield Road
Chesterfield
Derbyshire
S41 8JT
United Kingdom

Tel: +44 (0) 844 287 0007
FAX: +44 (0) 844 287 0006

Sales email:	sales@t-mac.co.uk
Support email:	support@t-mac.co.uk
Support telephone:	+44 (0) 844 287 0008

t-mac website:	www.t-mac.co.uk
t-mac user/web portal:	www.my-tmac.co.uk

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User Manual Part no: 065-0056

User Manual Revision: 3.0.0

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Introduction

Sanyo/Panasonic manufactures a Communication adaptor (A/C Gateway) to allow their air-conditioning units to be controlled by an external Building Management System (BMS).

The Sanyo (SHA-KA128AGB) and Panasonic (CZ-CFUNC2) A/C Gateways have an RS-485 port which allows them to interface with the Panasonic/Sanyo A/C Interface (TCP interface) using Panasonic/Sanyo's proprietary S-NET protocol. The TCP interface will analyse the system on power up and expose information over Modbus. The system will update the information continuously and relevant air-conditioning settings will have read/write access while other information will be read only.

Unpacking

The TCP interface contains the following items:

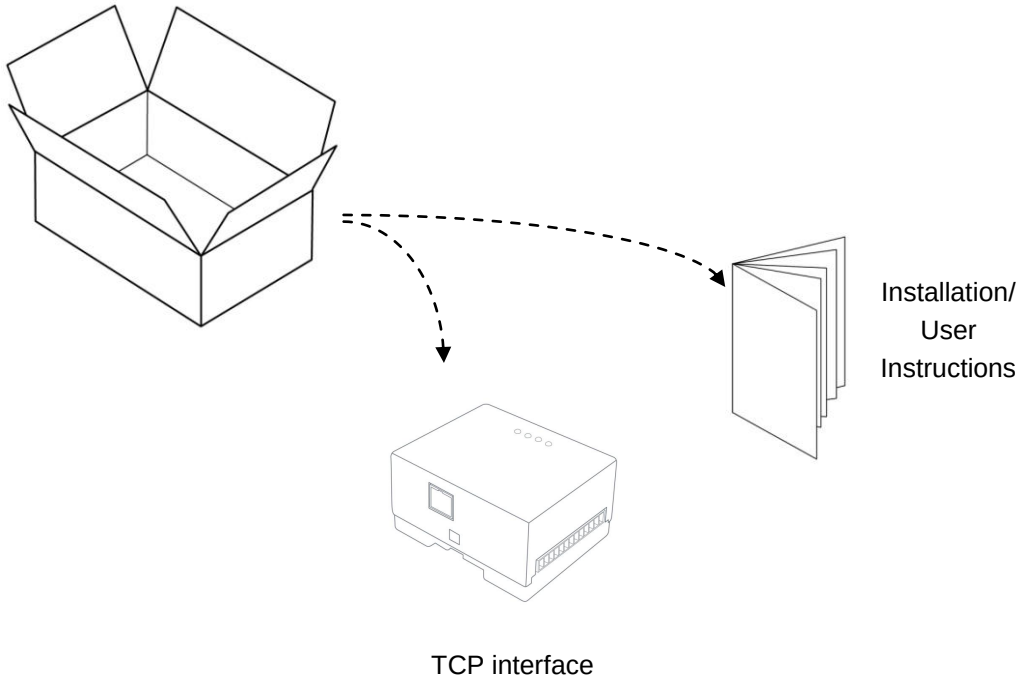


Figure 1: Kit content

Installation

This chapter gives step-by-step instructions for setting up a new TCP interface installation.

Overview

The TCP interface has been designed to be installed in residential, commercial, light and heavy industrial environments. The TCP interface system should be installed in a manner that complies with the Health and Safety Executive (HSE) Memorandum of Guidance on Electricity at Work Regulations 1989.

TCP interface hardware overview

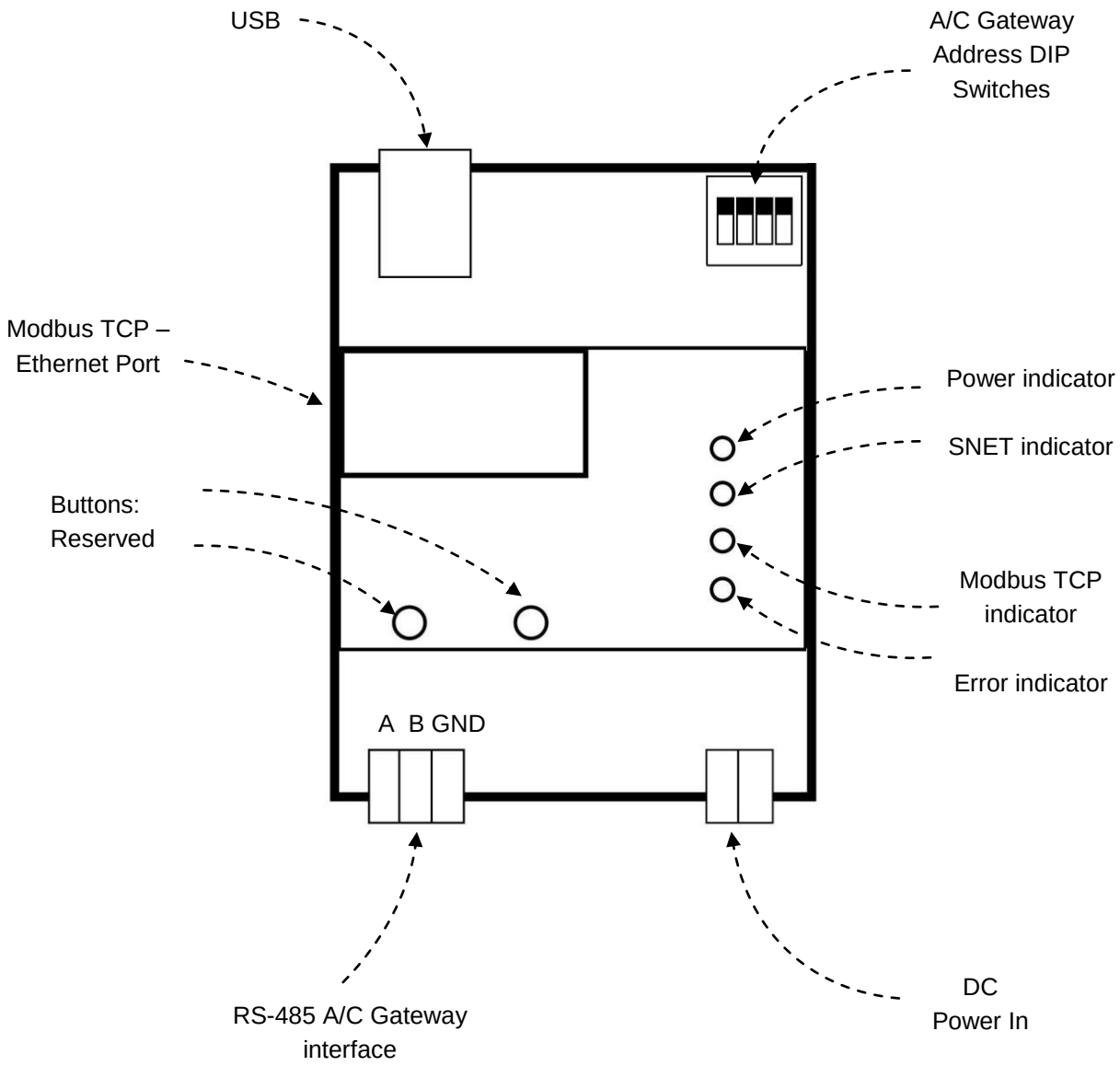


Figure 2: *TCP interface hardware overview*

Mounting

The TCP interface should be mounted next to, or near to the A/C Gateway. Suitable space should be provided all around the TCP interface to allow for cable conduit and additional equipment. The TCP interface should be located so that it is easy to view the LED indicators to assist with debugging.

Enclosure dimensions

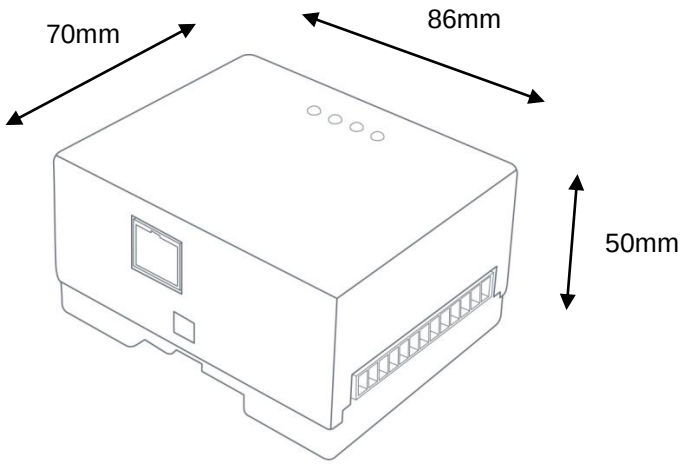


Figure 3: TCP interface dimensions

Removing the enclosure lid

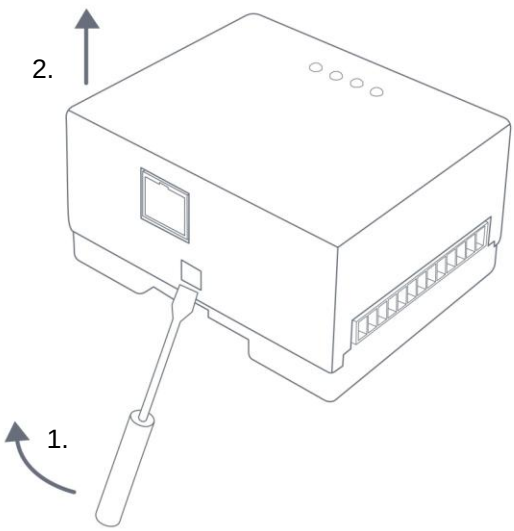


Figure 3: TCP interface lid removal

Mounting points

The TCP interface comes complete with a convenient DIN Rail Mounting base for easy installation on standard 35mm wide DIN rail.

Wall mounting brackets can be supplied by t-mac technologies to allow the TCP interface to be installed directly onto a wall. (t-mac order #: 500-52556)

Connecting power

The TCP interface requires a 10-30VDC (250mA at 24V) supply.

10-30VDC supply should be connected to the terminal plugs indicated below.

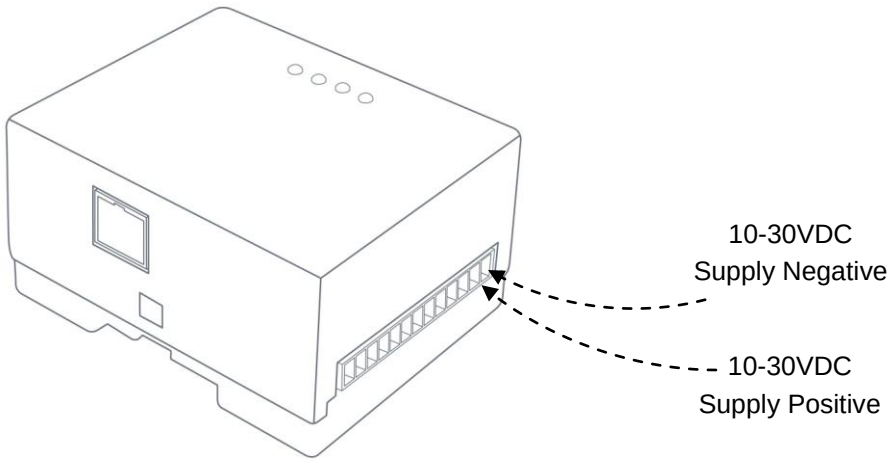


Figure 5: 10-30VDC terminal connection

⚠ DO NOT APPLY POWER YET.

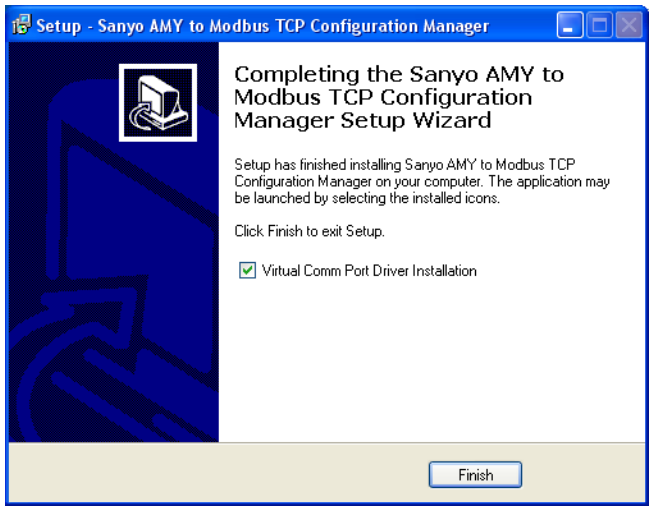
For troubleshooting information regarding powering TCP interface, see the *Troubleshooting* chapter.

Configuration software

The TCP interface Configuration Manager is an application that may be installed on a PC. It allows the TCP interface's communications settings to be configured over USB.

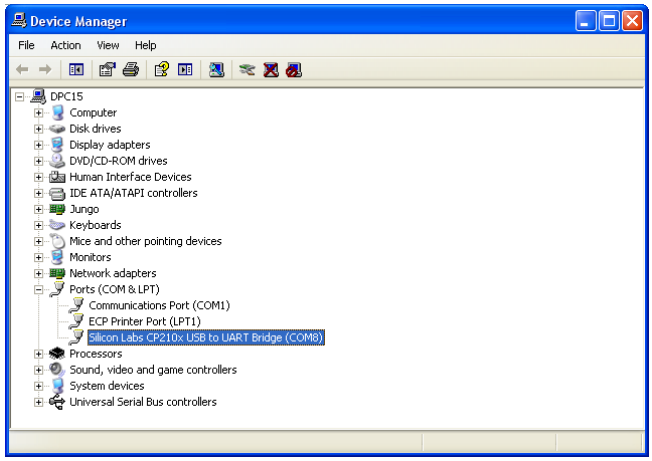
Installing the TCP interface configuration software

1. Install the software by running "SanyoAMYtoModbusConfigSoftwareV1.exe". Ensure that you select the "Virtual Comm Port Drivers Installation". Follow the instructions on screen to complete the installation.

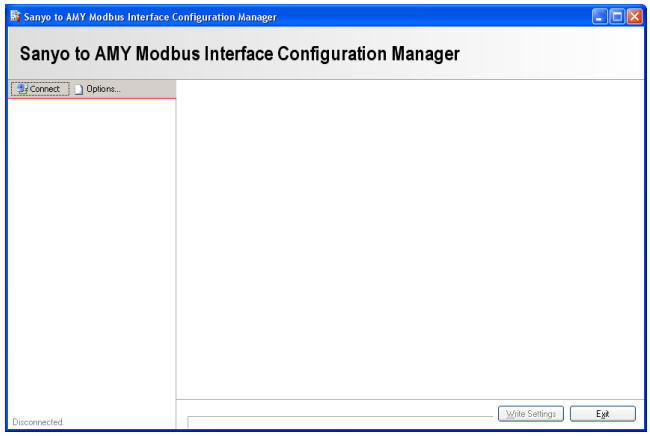

Setup - Sanyo AMY to Modbus TCP Configuration Manager
Completing the Sanyo AMY to Modbus TCP Configuration Manager Setup Wizard
Setup has finished installing Sanyo AMY to Modbus TCP Configuration Manager on your computer. The application may be launched by selecting the installed icons.
Click Finish to exit Setup.
Virtual Comm Port Driver Installation
Finish

Using the TCP interface configuration software

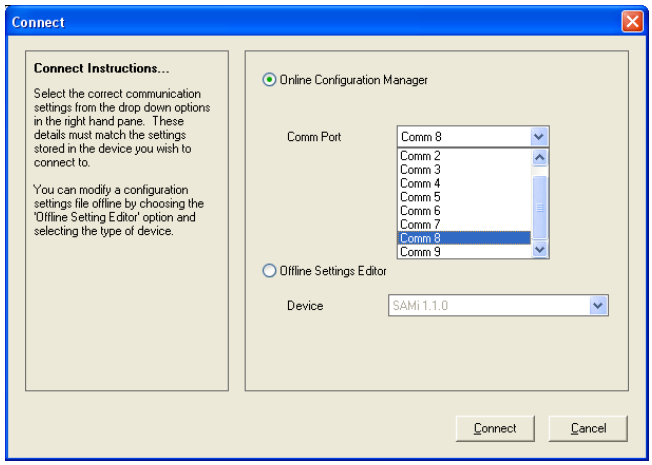
1. When the installation has completed, ensure the power is removed and connect a USB cable to the TCP interface. Determine which Comm Port the unit appears as, using Windows Device Manager.



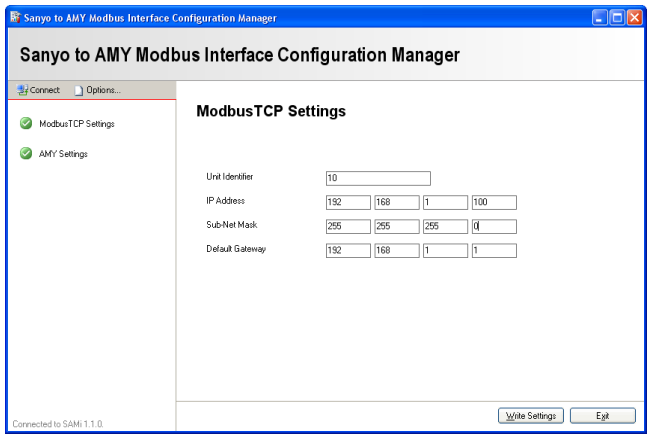
2. Apply Power to the TCP interface and run “Sanyo AMY to Modbus TCP Configuration Manager” and click “Connect”.



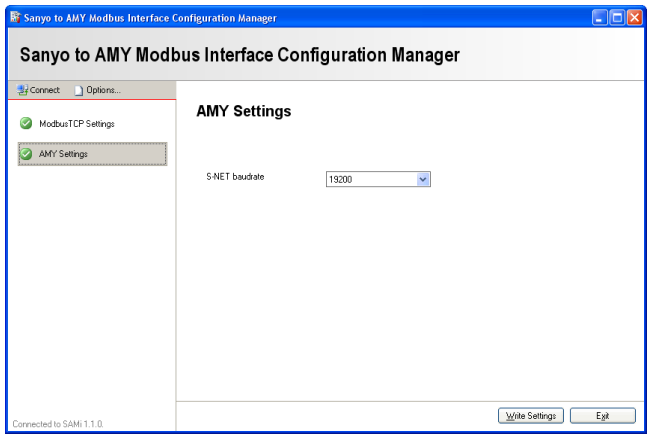
3. Select the appropriate Comm Port and click “Connect”.


Connect
Connect Instructions...
Select the correct communication settings from the drop down options in the right hand pane. These details must match the settings stored in the device you wish to connect to.
You can modify a configuration settings file offline by choosing the 'Offline Setting Editor' option and selecting the type of device.
Online Configuration Manager
Comm Port
Comm 8
Comm 2
Comm 3
Comm 4
Comm 5
Comm 6
Comm 7
Comm 8
Comm 9
Offline Settings Editor
Device
SAMi 1.1.0
Connect
Cancel

4. The TCP interface’s current settings are displayed. There are two pages of information. The “Modbus TCP Settings” apply to communications between a Building Management System (or other Modbus-TCP Master) and the TCP interface.



5. The “AMY Settings” apply to communication between the TCP interface and A/C Gateway.



6. Click “Write Settings” to write the desired settings to the TCP interface.

7. Click Exit when complete.

8. Disconnect the USB cable and power from the TCP interface. Upon re-applying power the new settings will take effect.

Settings

DIP switches

There is a bank of 4 DIP switches on the TCP interface circuit board labelled as ‘ADDRESS’. These switches must be configured to match the A/C Gateway address.

Switch #	switch value when ON
1	1
2	2
3	4
4	8

To get the address, add together the value for each switch set to ON. For example, to set the address to 13, set switches 1, 3 and 4 ON (1 + 4 + 8) = Address 13.

Baud rates

The baud rate of communications used between the TCP interface and A/C Gateway can be set to 19200 or 9600 baud using the Configuration Software.

Fixed communications settings

The following TCP interface to A/C Gateway communication settings are fixed and cannot be changed:

- 8 Data bits
- Even Parity
- 1 Stop Bit.

RS-485 termination

Depending upon the application, environment and length of connection between the TCP interface and the A/C Gateway, termination and/or pull up/down resistors might be required. The TCP interface has built in jumper selectable termination and pull up/down resistors located above the RS-485 connection.

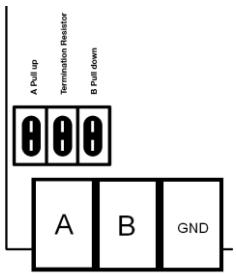


Figure 6: RS-485 termination jumpers

Modbus TCP unit identifier

Any Modbus TCP unit identifier in the range 1 – 247 can be chosen using the Configuration Software.

Please note: Each TCP interface using the same IP address must have a unique Unit Identifier. If using the central address based view of the AC units all information is exposed over the same Unit Identifier. This is the typical situation.

However if using the System based view of the AC units there must be at least 61 Unit Identifier addresses between converters. For example if the first is set to Unit Identifier 10 the next converter (or other MODBUS device) should be set to 71 or greater.

Initial power on

Once the TCP interface has been configured and the Ethernet port and A/C Gateway are connected, apply power to the unit.

All LEDs will initially light up for 5s and then go off.

*The **Power** indicator will start flashing slowly to indicate that the A/C Gateway is scanning.*

*The **SNET** indicator will start flashing to indicate communications between the TCP interface and A/C Gateway.*

*The **Modbus TCP** indicator will start flashing slowly to indicate configuration of the Ethernet module is in progress.*

*After about 30s the **Modbus TCP** indicator will go solid to indicate configuration of the Ethernet module is complete. If a Modbus Master is polling the device the LED will then flash for every valid communication transaction.*

After about 2 minutes the Power LED will go solid if the A/C Gateway has discovered any air-conditioning units.

Summary of status indicators

There are 4 status LEDs on the TCP interface. During configuration all LEDs are on. During normal operation the LED indications are as follows:

Indicator	Description
Power	**On steadily (Start-up 5s)** – Device is powered **Slow flash** – configuring the A/C Gateway **On steadily (Normal Operation)** – the A/C Gateway has successfully detected units
SNET	**On steadily (Start-up 5s)** – Device is powered **Intermittent flash** – Indicates a valid transaction with the A/C Gateway.
Modbus TCP	**On steadily (Start-up 5s)** – Device is powered **Slow flash** – configuring the Modbus TCP link **Intermittent flash** – Indicates a valid Modbus TCP transaction.
Error	**On steadily (Start-up 5s)** – Device is powered **Single Flash** – Error configuring A/C Gateway **Double Flash** – Error reading from A/C Gateway **Treble Flash** – Error writing to A/C Gateway **Quadruple Flash** – Other Error

Modbus TCP

Modbus TCP explained

Modbus is a master-slave protocol, which means there are two types of Modbus device, Modbus *Masters* and Modbus *Slaves*.

Slave devices simply wait until they receive a command from a Master, act upon that command and send a reply to the Master. Slaves do not have the ability to send commands to other devices on the bus. Master devices are responsible for sending commands to slave devices and receiving data. Modbus only permits there to be one Master device on the bus at any one time, but up to 247 slaves can be connected at a time.

Each Slave device must have a unique ID on the bus, which is referred to as a *Unit Identifier*.. Each Modbus command the Master sends will contain this Unit Identifier and only the Slave with that ID will reply.

Modbus register table

Modbus Slave devices store data in registers. There are four register types and each type has its own register bank. Any 32-bit values exposed over 2 registers will have the most significant word (MSW) in the first register. The register types are summarised below:

Register Name	Register Type	Description
Discrete Input	Digital Input	Read only register used for holding status information which holds a value of 0 or 1. Can be read using function code 0x02.
Coil	Digital Output	Read and write accessible register which holds a value of 0 or 1. Can be read using function code 0x01. Can be written using function code 0x05 or 0x0F.
Input Register	Analogue Input	Read only register used for status information which holds a 16-bit value (0-65535). Can be read using function code 0x04.
Holding Register	Analogue Output	Read and write accessible register used for status information which holds a 16-bit value (0-65535). Can be read using function code 0x03. Can be written using function code 0x06 or 0x10.

Native TCP interface registers

The TCP interface will provide the following MODBUS registers at the base Unit Identifier specified by the Configuration Software.

Coils

Coils (Discrete Outputs)		
Register Name	Location (decimal)	Details
Global On/Off	0	0x00 = Off 0x01 = On

Holding registers

Holding Registers (Analogue Outputs)			
Register Name	Location (decimal)	Length	Details
Global Mode	0	1	1 heat 2 cool 3 fan 4 dry 5 auto
Global Setpoint	1	1	0xFF = 92.5degC - 0x00 = -35degC
Global Converted Setpoint	2	1	Value in degC
Reset Request	3	1	Write 0x55 (85 decimal) to reset the device.

Input registers

Input Registers (Analogue Inputs)			
Register Name	Location (decimal)	Length	Details
Link 1 State	0	1	Startup = 1,2, 3 & 4 Read = 5, Write = 6 & 7 Error = 8
Link 1 Address	1	1	0 – 30 (even numbers only)
Link 1 Number Units	2	1	0-64
Link 1 Global Fault Code	3	1	0x00 – 0xFF
Link 2 State	4	1	Startup = 1,2, 3 & 4 Read = 5, Write = 6 & 7 Error = 8
Link 2 Address	5	1	1 – 31 (odd numbers only)
Link 2 Number Units	6	1	0-64
Link 2 Global Fault Code	7	1	0x00 – 0xFF
Firmware Version	8	1	0-65535

SNET baud rate (MSW)	9	2	9600 or 19200
SNET baud rate (LSW)	10		
Adapter address (DIP switches)	11	1	0x00 – 0x0F (eg. 0x0C = 12)

Link 1 Unit 1 address	20	1	101 - 3016
Link 1 Unit 2 address	21	1	101 - 3016
Link 1 Unit 3 address	22	1	101 - 3016
...	...	...	....
Link 1 Unit 62 address	81	1	101 - 3016
Link 1 Unit 63 address	82	1	101 - 3016
Link 1 Unit 64 address	83	1	101 - 3016

Link 2 Unit 1 address	100	1	101 - 3016
Link 2 Unit 2 address	101	1	101 - 3016
Link 2 Unit 3 address	102	1	101 - 3016
...	...	...	....
Link 2 Unit 62 address	161	1	101 - 3016
Link 2 Unit 63 address	162	1	101 - 3016
Link 2 Unit 64 address	163	1	101 - 3016

System information

Following on from the base Unit Identifier specified by the Configuration Software, each system appears sequentially with the following registers detailing system information starting at 000. For example Link 1 system 1 will be the next Unit Identifier after converter's Unit Identifier.

Input registers

Input Registers (Analogue Inputs)			
Register Name	Location (decimal)	Length	Details
Number of units in system	0	1	0-16

Discrete inputs

Discrete Inputs (Discrete Inputs)			
Register Name	Location (decimal)	Length	Details
System fault (one or more units in fault)	0	1	0 = no fault, 1 = fault detected

Indoor unit information

The following information will be exposed for each indoor unit starting at register X00 (where X is the unit number within a system eg. for unit 302 its registers will be on base Unit Identifier + 3 starting at 200. These will be available for each indoor unit in a system.

Input registers

Input Registers (Analogue Inputs)			
Register Name	Location (decimal)	Length	Details
Central Address	X00	1	Dependent on configuration. Z-XX, Z = zone, XX = unit Eg 101
Indoor Unit Address	X01	1	Dependent on configuration eg. 101, 102, 201, 301 ...3016
Fault Code	X02	1	0x00 (system OK) - 0xFF
Return Air Temperature	X03	1	0xFF = 92.5degC - 0x00 = -35degC
Converted Return Air Temperature	X04	1	Value in degC

Coils

Coils (Discrete Outputs)			
Register Name	Location (decimal)	Length	Details
ON/OFF status	X00	1	0 = Off, 1 = On
Filter status	X01	1	0 = Clean, 1 = Dirty

Holding registers

Holding Registers (Analogue Outputs)			
Register Name	Location (decimal)	Length	Details
Temperature Setpoint	X00	1	0xFF = 92.5degC - 0x00 = -35degC
Converted Temperature Setpoint	X01	1	Value in degC
Mode	X02	1	1 heat 2 cool 3 fan 4 dry 5 auto (indicates auto-heat when read) 6 auto-cool (this cannot be set. AC will decide whether to heat or cool when auto mode is set)
Fan Speed	X03	1	0 auto 1 high

			2 med 3 low
Flaps Position	X04	1	1 swing 2 F1 horizontal 3 F2 4 F3 45 degrees 5 F4 6 F5 vertical

Group information

AC units can be grouped together with up to 8 units per group. The following information will be exposed for each group starting at register XYY00 (where X is the link and YY is the central address). These registers are present on the base Unit Identifier. The following examples show how the different groups can be indexed:

- 10100 is central address 1 on link1.
- 10400 is central address 4 on link1
- 13400 is central address 34 on link1
- 20100 is central address 1 on link2

Discrete inputs

Discrete Inputs (Discrete Inputs)			
Register Name	Location (decimal)	Length	Details
Group fault (one or more units in fault)	XYY00	1	0 = no fault, 1 = fault detected

Input registers

Input Registers (Analogue Inputs)			
Register Name	Location (decimal)	Length	Details
Number of units within group	XYY00	1	will be 1 for units operating independently, up to maximum of 8
Converted Return Air Temperature	XYY01	1	Value in degC
1st unit Fault Code	XYY02	1	0x00 (system OK) - 0xFF
2nd unit Fault Code	XYY03	1	0x00 (system OK) - 0xFF
3rd unit Fault Code	XYY04	1	0x00 (system OK) - 0xFF
4th unit Fault Code	XYY05	1	0x00 (system OK) - 0xFF
5th unit Fault Code	XYY06	1	0x00 (system OK) - 0xFF
6th unit Fault Code	XYY07	1	0x00 (system OK) - 0xFF
7th unit Fault Code	XYY08	1	0x00 (system OK) - 0xFF
8th unit Fault Code	XYY09	1	0x00 (system OK) - 0xFF
1st unit Indoor Unit Address	XYY10	1	Dependent on configuration eg.

			101, 102, 201, 301 ...3016
2nd unit Indoor Unit Address	XYY11	1	Dependent on configuration eg. 101, 102, 201, 301 ...3016
3rd unit Indoor Unit Address	XYY12	1	Dependent on configuration eg. 101, 102, 201, 301 ...3016
4th unit Indoor Unit Address	XYY13	1	Dependent on configuration eg. 101, 102, 201, 301 ...3016
5th unit Indoor Unit Address	XYY14	1	Dependent on configuration eg. 101, 102, 201, 301 ...3016
6th unit Indoor Unit Address	XYY15	1	Dependent on configuration eg. 101, 102, 201, 301 ...3016
7th unit Indoor Unit Address	XYY16	1	Dependent on configuration eg. 101, 102, 201, 301 ...3016
8th unit Indoor Unit Address	XYY17	1	Dependent on configuration eg. 101, 102, 201, 301 ...3016

Coils

Coils (Discrete Outputs)			
Register Name	Location (decimal)	Length	Details
ON/OFF status	XYY00	1	0 = Off, 1 = On
Filter status	XYY01	1	0 = Clean, 1 = Dirty

Holding registers

Holding Registers (Analogue Outputs)			
Register Name	Location (decimal)	Length	Details
Converted Temperature Setpoint	XYY00	1	Value in degC
Mode	XYY01	1	1 heat 2 cool 3 fan 4 dry 5 auto (indicates auto-heat when read) 6 auto-cool (this cannot be set. AC will decide whether to heat or cool when auto mode is set)
Fan Speed	XYY02	1	0 auto 1 high 2 med 3 low
Flaps Position	XYY03	1	1 swing 2 F1 horizontal 3 F2 4 F3 45 degrees 5 F4 6 F5 vertical

Troubleshooting

This chapter gives suggested solutions to problems that users may encounter when installing and configuring a TCP interface.

Problems connecting via Ethernet (Modbus TCP)

If it is not possible to connect to the unit:

- Check that the unit identifier, IP address sub-net mask and default gateway are set correctly using the PC configuration software.

If the Modbus TCP LED is permanently on, this indicates that the TCP interface is configured, but no valid communication traffic is present:

- Please check the communication settings. Also ensure that the unit is wired correctly using a cross-over or straight-through cable as appropriate.

The TCP interface is not working

If the TCP interface does not appear to be powered up, try the following:

- Check the supply to the TCP interface with a multimeter.

  If required additional DIN rail mounted power supplies can be purchased from t-mac to power external devices:
  Order number: 001-1190 – 100-240VAC to 24VDC at 1.1A

A/C Gateway is not communicating

If the TCP interface does not appear to be communicating with the A/C Gateway, try the following:

- Ensure the baud rate is set correctly.
- Try adjusting the termination jumper settings for this channel on the TCP interface.
- Ensure the correct address is set on the A/C Gateway and this matches the value set on the TCP interface DIP switches.

Technical specification

Parameter	Min.	Typ.	Max.	Comments
Power supply				
Voltage	10V DC	24V DC	30V DC	Connection via 1x 2-way 3.81mm
Current		0.25A		pitch connector
Terminals				
Cable size				
3.81mm pitch connectors			16AWG	
			1.5mm²	
Indicators				
4 Status LEDs				Power, SNET, Modbus TCP and Error
Communication Ports				
Ethernet		10Mb/s		Connection via RJ45 connector
RS485		9600b/s	115200b/s	Connection via 3.81mm 3-way connector
USB	USB 1.1		USB 2.0	USB Type B
Environmental				
Operating temperature	-10°C		40°C	
Storage temperature	-20°C		50°C	
Relative humidity			90%	Non-condensing
Environment resist		IP30		
Dimensions				
Length		86mm		
Width		70mm		
Depth		50mm		
Weight		0.22kg		

Appendix A

Manufacturer's 1-year limited warranty

t-mac Technologies Ltd. ("t-mac") warrants all products against defects in materials and workmanship for a period of one (1) year from the date of original consumer purchase in the U.K. If a defect exists during the warranty period, t-mac at its option will either repair (using new or remanufactured parts) or replace (with a new or remanufactured unit) the product at no charge.

THE WARRANTY WILL NOT APPLY TO THE PRODUCT IF IT HAS BEEN DAMAGED BY MISUSE, ALTERATION, ACCIDENT, IMPROPER HANDLING OR OPERATION, OR IF UNAUTHORIZED REPAIRS ARE ATTEMPTED OR MADE. SOME EXAMPLES OF DAMAGES NOT COVERED BY WARRANTY INCLUDE, BUT ARE NOT LIMITED TO, BATTERY LEAKAGE, BENDING, OR VISIBLE CRACKING OF THE PCB, WHICH ARE PRESUMED TO BE DAMAGES RESULTING FROM MISUSE OR ABUSE.

Product returns

Customers wishing to return products or other accessories to t-mac Technologies Ltd. must first call our office (0844 287 0007) and obtain a Return Authorisation (RA) number. RA numbers are valid for 30 days from the date of issuance, and must be obtained within 30 days of purchase date.

Defective products are eligible for credit or replacement within 30 days of Customer invoice date. Replacements will be shipped upon receipt of defective merchandise via ground shipment at our expense, unless customer requests an upgrade at their expense. Advance replacements are available, but must be paid for at the time replacement ships. Shipping address will be provided to customer at issuance of RA. Return shipping on defective merchandise may be reimbursed up to the original shipping cost of the item. Packages must have RA number written visibly on shipping box with a brief description of the product defect inside. All items must be returned in the original packaging. t-mac Technologies Ltd. is not responsible for any item not received at its return address. Allow 14-21 business days for processing returns.

Appendix B

Fault codes

The following list details how fault codes are reported by both the TCP interface and a Panasonic/Sanyo wall controller.

TCP interface	Wall Controller	Description
32	C00	Unused
33	C01	Poor setting on Control Address (duplicated).
34	C02	Discord of number of units in central process control.
35	C03	Mis-wiring of central process control.
36	C04	Misconnection of central process control.
37	C05	Transmission error of central process control.
38	C06	Reception error of central process control.
44	C12	Lump alarm by local adapter.
48	C16	Poor transmission of the adapter to the unit.
49	C17	Poor reception of the adapter from the unit.
50	C18	Duplicated control addresses in the adapter.
51	C19	Duplication of adapter addresses.
52	C20	Unused
53	C21	Non-volatile memory in the adapter is abnormal.
54	C22	Poor setting of adapter address.
55	C23	Faulty host terminal (software).
56	C24	Faulty host terminal (hardware).
57	C25	Abnormal processing of the host terminal.
58	C26	Communication error in the host terminal.
63	C31	Change of constitution (the adapter detects the change).
64	E00	Unused
65	E01	Poor reception of the signal on the remote controller.
66	E02	Poor transmission of the signal on the remote controller.
67	E03	Poor reception of the indoor unit from the remote controller(central process control).
68	E04	Poor reception of the indoor unit from the outdoor unit.
69	E05	Poor transmission of the indoor unit to the outdoor unit.
70	E06	Poor reception of the outdoor unit from the indoor unit.
71	E07	Poor transmission of the outdoor unit to the indoor unit.
72	E08	Duplicated setting of indoor unit's address.
73	E09	Setting multiple master remote controllers.
74	E10	Unused
75	E11	Poor reception of the indoor unit from the signal output P.C.B.. (CR-3WAY TG)
76	E12	No auto address setting. (Auto address is in setting)
77	E13	Poor transmission of indoor unit to the remote controller.
78	E14	Duplicated address of master indoor unit in group processing control.

79	E15	Alarm for auto address setting.(Number of indoor units is too small.)
80	E16	Alarm for auto address setting.(Number of indoor units is too large.)
81	E17	Poor transmission from outdoor unit to indoor unit.
82	E18	Poor communication of group processing control caused by miswiring.
83	E19	Unused
87	E23	Poor transmission of CCU to outdoor sub bus.
88	E24	Poor reception of CCU from outdoor sub bus.
89	E25	Poor setting of outdoor sub bus address. (duplicated)
90	E26	Discord of number of outdoor sub bus units.
91	E27	Mis-wiring of outdoor sub bus.
92	E28	Misconnection of outdoor units.
93	E29	Poor reception of outdoor serial.
94	E30	Poor transmission of outdoor serial.
96	F00	Unused
97	F01	Abnormal sensor for the inlet temp. on the heat exchanger of the indoor unit.
98	F02	Abnormal sensor for mid-point temp. on the heat exchanger of the indoor unit.
99	F03	Abnormal sensor for the outlet temp. on the heat exchanger of the indoor unit.
100	F04	Abnormal sensor for the outlet temperature of the PC compressor.
101	F05	Abnormal sensor for the outlet temperature of the AC compressor.
102	F06	Abnormal sensor for the inlet temp. on the heat exchanger of the outdoor unit.
103	F07	Abnormal sensor for the outlet temp. on the heat exchanger of the outdoor unit.
104	F08	Abnormal sensor for outdoor temperature.
105	F09	Actuation of scroll compressor protective thermostat.
106	F10	Abnormal sensor for suction temperature of indoor unit.
107	F11	Abnormal sensor for discharge temperature of indoor unit.
108	F13	Abnormal sensor for cooling water temperature.
110	F14	Abnormal sensor for engine room temperature.
112	F16	Abnormal sensor for suction and discharge gas.
114	F18	Abnormal sensor for exhaust gas temperature.
115	F19	Abnormal sensor for compressor bottom temperature.
117	F21	Abnormal sensor for compressor 3 current.
118	F22	Abnormal sensor for discharge gas temperature from compressor 3.
119	F23	Abnormal sensor for refrigerant gas 2 temperature in the heat exchanger.
120	F24	Abnormal sensor for liquid refrigerant 2 temperature in the heat exchanger.
121	F25	Abnormal sensor for heat exchanger coil 1 temperature.
122	F26	Abnormal sensor for heat exchanger coil 2 temperature.
123	F27	Abnormal sensor for compressor 1 current.
124	F28	Abnormal sensor for compressor 2 current.
125	F29	Abnormal non-volatile memory (EEPROM) in indoor unit.
126	F30	Abnormal timer (RTC).
127	F31	Abnormal non-volatile memory (EEPROM) in outdoor unit.
128	H00	unused

129	H01	Incorrect current value for compressor 1 .(over current)
130	H02	Incorrect current value for compressor 1 .(locked compressor)
131	H03	CT sensor is dislocated from compressor 1, Short circuited.
132	H04	Protective thermostat for scroll compressor 1.
133	H05	Protective thermostat for scroll compressor 1 is slipped off.
134	H06	Activation of low pressure switch.
135	H07	No oil in compressor 1.
136	H08	Incorrect connection of oil sensor 1.
137	H09	Chattering of magnet switch 1 .(Multi)
138	H10	Defective sensor for crank case heater 1.
139	H11	Incorrect current value for compressor 2 .(over current)
140	H12	Incorrect current value for compressor 2 .(locked compressor)
141	H13	CT sensor is dislocated from compressor 2, short circuit.
142	H14	Protective thermostat for scroll compressor 2.
143	H15	Protective thermostat for scroll compressor 2 is dislocated.
144	H16	No oil in compressor 2.
145	H17	Sensed unbalanced power voltage.
146	H18	Chattering of magnet switch 1 (Espacio).
147	H19	Chattering of magnet switch 2 .
148	H20	Defective sensor for crank case heater 2.
149	H21	Incorrect current value for compressor 3 .(over current)
150	H22	Incorrect current value for compressor 3 .(locked compressor)
151	H23	CT sensor is dislocated from compressor 3, short circuited.
152	H24	Protective thermostat for scroll compressor 3.
153	H25	Protective thermostat for scroll compressor 3 is slipped off.
154	H26	No oil in compressor 3.
155	H27	Incorrect connection of oil sensor 2.
156	H28	Incorrect connection of oil sensor 3.
157	H29	Chattering of magnet switch 3.
158	H30	Defective sensor for crank case heater 3.
192	L00	Unused
193	L01	Incorrect address for indoor unit. (No master indoor unit.)
194	L02	Mismatch of indoor and outdoor units.
195	L03	Setting plural master indoor units for group control.
196	L04	Duplicate setting of system address (outdoor unit).
197	L05	Duplicate setting of priority indoor unit. (for priority indoor unit)
198	L06	Duplicate setting of priority indoor unit. (for other than priority indoor unit.)
199	L07	Group control wiring to individually controlled indoor unit.
200	L08	No Setting of indoor unit address.
201	L09	No Setting of indoor unit capacity.
202	L10	No Setting of outdoor unit capacity.
203	L11	Mis-wiring of group control wire. (Espacio)
204	L12	Discord of indoor unit’s capacity. (Multi)
205	L13	Poor setting of indoor unit’s type.
206	L14	Discord of power frequency. (50,60Hz)

207	L15	Defective double duct bearing.
224	P00	Unused
225	P01	Abnormal indoor fan motor.
226	P02	Actuation of outdoor fan motor, protective thermostats for CM and AC.
227	P03	High discharge temperature of compressor.
228	P04	Actuation of high refrigerant pressure switch.
229	P05	Reversed phase of the power source.
233	P09	Poor connection of ceiling panel connector for indoor unit.
234	P10	Actuation of indoor unit float switch.
239	P15	No refrigerant gas.
241	P17	Abnormal discharge gas temperature from compressor 2.
242	P18	Abnormal discharge gas temperature from compressor 3.
244	P20	Abnormally high refrigerant gas pressure.
245	P21	Abnormal pressure difference in compressor oil.
254	P30	Abnormal sub indoor units in group control. (Centralized processing control detected the abnormality.)
255	P31	Abnormal group control.